GPS ASSISTANCE DATA DELIVERY METHOD AND SYSTEM

CLAIM OF PRIORITY FROM A COPENDING PROVISIONAL PATENT APPLICATION

Priority is herewith claimed under 35 U.S.C. §119(e) from copending Provisional Patent Application No. 60/133,062, filed May 7, 1999, by Kari Pihl and Hannu Pirilä. Priority is also herewith claimed under 35 U.S.C. §119(e) from copending Provisional Patent Application No. 60/133,287, filed May 10, 1999, by Kari Pihl and Hannu Pirilä. The disclosure of each of these Provisional Patent Applications is incorporated by reference herein in its entirety.

FIELD OF THE INVENTION

This invention relates generally to wireless telecommunications systems and, more particularly, to signalling between a mobile terminal and a wireless network for use in obtaining mobile terminal position location information.

BACKGROUND OF THE INVENTION

The use of the Global Positioning System (GPS) satellite constellation for obtaining a terrestrial position fix (latitude and longitude) is widespread and well known. It has been proposed that mobile terminals (such as, but not limited to, cellular telephones) in modern wireless telecommunications systems include a capability to receive the GPS signals and to thereby calculate their position on the surface of the Earth.

In order to improve the performance of position calculation as compared to stand-alone GPS a mobile terminal can have, in addition to GPS receiver capability, access to so-called GPS Assistance Data. The GPS Assistance Data is the same for all GPS capable mobile terminals within a given location area, and it would appear that the most straightforward technique would be to broadcast (i.e., point-to-multipoint) the GPS Assistance Data to all GPS-capable mobile terminals within the location area. The Assistance Data is not specific to any one mobile terminal, but can instead be used by a plurality of the GPS-capable mobile terminals. The GPS Assistance Data is composed of a large amount of data (about 500 bits/satellite) that is required to be delivered from the network side of the wireless telecommunications system to the GPS-capable mobile terminals. The GPS Assistance Data contains the following elements:

(A) Number of satellites

(B) Reference time

(C) Reference location (the serving Base Transceiver Station (BTS) location)

(D) Satellite ID, Ephemeris, clock corrections, etc.

(E) Optional DGPS corrections.

However, in current wireless telecommunication protocols, such as the one known as the Global System for Mobile Communications, or GSM, the capacity of the point-to-multipoint broadcast channels (e.g., BCCH, SMS-CB) is limited. As such, it would be difficult or impossible in a practical sense to fit the required GPS Assistance Data into the currently defined point-to-multipoint broadcast channels.

OBJECTS AND ADVANTAGES OF THE INVENTION

It is a first object and advantage of this invention to provide an improved signalling technique to enable GPS Assistance Data to be delivered to a mobile terminal.

It is a further object and advantage of this invention to provide an improved signalling technique to enable GPS Assistance Data to be delivered to a mobile terminal using a point-to-point signalling protocol, as opposed to a point-to-multipoint (broadcast) protocol.

It is a further object and advantage of this invention to improve performance of a mobile terminal in a power-on stage, as well as the overall GPS accuracy, while active in the wireless network, as compared to stand-alone GPS.

SUMMARY OF THE INVENTION

The foregoing and other problems are overcome and the objects of the invention are realized by methods and apparatus in accordance with embodiments of this invention.

This invention teaches a method whereby GPS Assistance Data is transmitted to GPS-capable mobile terminals. The mobile stations receiving this data are thereby enabled to accurately calculate their own positions, in conjunction with received GPS signals. An example of the utility of this invention is its use in the Global System for Mobile Communications (GSM) Phase 2, plus Location Services (LCS) protocols, but this important application is only one of many wherein the teachings of this invention can be used with advantage.

The inventors have realized that one property of the GPS Assistance Data, which may be used in a Network Assisted Mobile Terminal GPS (NAMT-GPS) system, is that the lifetime of the GPS Assistance Data is relatively long (about 2 hours). To establish a point-to-multipoint broadcast channel for this type of long lifetime data is thus unnecessary and wasteful of system resources. The GPS Assistance Data can instead best be delivered to GPS-capable mobile terminals using point-to-point signalling protocols, preferably employing already defined point-to-point signalling protocols and message types. The long lifetime of the GPS Assistance Data thereby enables the wireless network to use the following exemplary GSM procedures for delivering the GPS Assistance Data from the network to the mobile terminal: IMSI (International Mobile Subscriber Identify) Attach, Normal Location Update, Periodic Location Update.

In accordance with the teachings of this invention no point-to-multipoint broadcast channel is required to be established or used for sending the GPS Assistance Data to the mobile terminals. Instead the GPS Assistance Data is transmitted to GPS-capable mobile terminals in a point-to-point manner using, for example, already defined IMSI Attach and Location Update procedures. In this way the network loading is not adversely affected by a requirement to provide a broadcast channel for this purpose.

A Network Assisted Mobile Terminal GPS system, in accordance with this invention, thus includes a plurality of GPS-capable mobile terminals each having a transceiver, and a wireless telecommunications network having at least one base site transceiver for transmitting GPS Assistance Data to individual ones of the plurality of GPS-capable mobile stations using a point-to-point signalling protocol. In the illustrative embodiment described herein the point-to-point signalling protocol is comprised of at least one of an IMSI (International Mobile Subscriber Identity) Attach, a Normal Location Update, or a Periodic Location Update signalling protocol.

BRIEF DESCRIPTION OF THE DRAWINGS

The above set forth and other features of the invention are made more apparent in the ensuing Detailed Description of